



## Performance Based Navigation (PBN)

### Untangling the Airspace

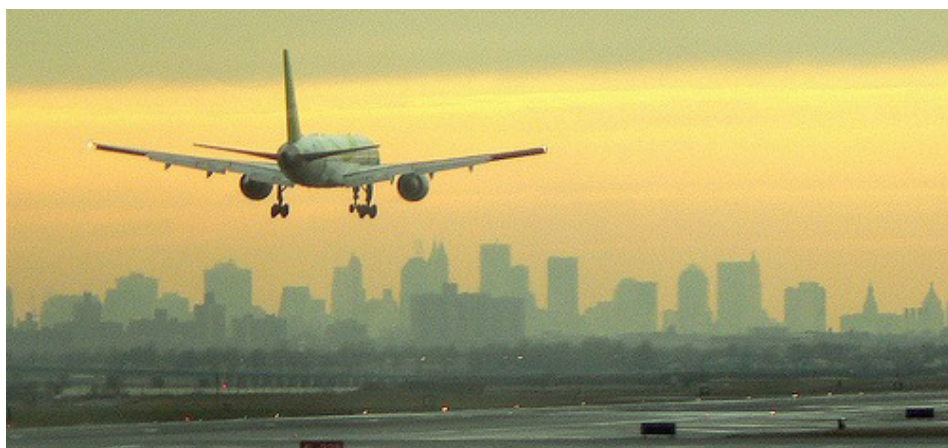
#### Performance Based Navigation

**(PBN)** delivers new routes and procedures that primarily use satellite-based navigation and on-board aircraft equipment to navigate with greater precision and accuracy and can provide benefits through all phases of flight. It provides a basis for designing and implementing automated flight paths, airspace redesign and obstacle clearance.

PBN benefits include shorter, more direct flight paths, improved airport arrival rates, enhanced controller productivity, increased safety due to repeatable, predictable flight paths, fuel savings and a reduction in aviation's adverse environmental impact. This key element of the Next Generation Air Transportation System (NextGen) provides a framework for defining performance requirements in navigation specifications.

**Area Navigation (RNAV)** is a method of navigation that permits aircraft operation on any desired flight path within the coverage of ground or space-based navigation aids or within the limits of the avionics onboard the aircraft, or a combination of these.

**Required Navigation Performance (RNP)** increases the precision of RNAV through computer-based RNAV performance monitoring and alerting aboard the aircraft. This



includes flying precise curved paths, giving air traffic controllers more options and enabling them to relieve or eliminate conflicts between approaches to or takeoffs from airports that are located close to each other.

A defining characteristic of RNP operations is the ability of the navigation system in an equipped aircraft to monitor the navigation performance it achieves and inform the crew if the performance does not meet requirements during an operation.

**Q-Routes and T-Routes** apply RNAV to en route airspace. Q-Routes are available for RNAV-equipped aircraft operating between 18,000 and 45,000 feet. T-Routes are at altitudes lower than 18,000 feet, sometimes down to 1,200 feet above ground level.

**Wide Area Augmentation System/Localizer Performance with Vertical Guidance (WAAS/LPV)** provides approaches

comparable to those of an Instrument Landing System (ILS) without the need for ILS's ground infrastructure. The capability improves access to many airports in reduced visibility, with an approach aligned to the runway.

For updates about RNAV, RNP and Q- and T-Routes, visit the [Instrument Flight Procedures Inventory Summary](#) page on the FAA website.

For updates on WAAS/LPV approaches, see the [Navigation Programs – Satellite Navigation](#) page on the FAA website.

[PBN Implementation Tables](#) are also available on the FAA website.

**Optimized Profile Descent (OPD)** is a special type of PBN procedure that keeps arrival aircraft at cruise altitude as long as possible before beginning a descent. Once begun, the procedure departs from the usual pattern of descend, level off, step

by step, all the way down. In a best-case scenario, an aircraft on an OPD is cleared to descend to final approach using the most economical power setting, at or near idle, and minimizing or eliminating the level-off flying for which greater power must be applied. OPDs reduce fuel consumption, emissions and noise.

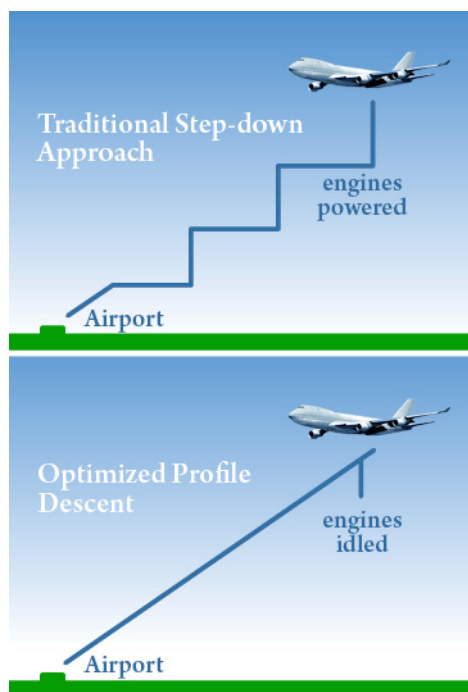
### Optimization of Airspace and Procedures in the Metroplex (OAPM)

The benefits of PBN are most evident in a metroplex, a large area with at least one major airport and several lesser airports, where arrivals and departures are most likely to be complicated and to conflict from one airport to another. The FAA also found that combining the development of PBN procedures with changes in airspace design were mutually beneficial and sometimes necessary for either improvement to be beneficial.

The FAA increased its focus on metroplexes and developed a program, OAPM, which combines work on PBN procedures and airspace redesign in metroplex areas varying in size and complexity. In each OAPM metroplex, studies determine what improvements should be made, and design and implementation teams implement the improvements. Stakeholders and subject matter experts with ties to the metroplex, including FAA managers and air traffic controllers, airlines and airport officials, participate throughout.

### PBN Dashboard

Metroplexes that did not become OAPM projects have continued their work to implement PBN



procedures. The FAA tracks their progress, and progress at more than 200 other airports, on the [PBN Dashboard](#), a web-based tool developed in collaboration with the National Air Traffic Controllers Association and MITRE, a federally-funded non-profit research and development organization. The dashboard provides information about the location of RNAV and RNP approach and departure procedures, within and outside OAPM projects, with available operational use.

An update on continuing PBN development for metroplexes [within OAPM projects](#) is available for download from the NextGen website, as is an update on metroplexes [outside OAPM](#).

### Implementation and Harmonization

One of the challenges in implementing PBN throughout the National Airspace System (NAS) is the need to update existing regulations, directives and standard operating procedures.

During design, the FAA identifies needed changes to governance and guidelines. In addition, to meet stringent performance safety and evaluation standards, much of the procedure design depends on specific safety and flight criteria in the automated tools used to develop these procedures. Conformance with environmental standards is also of primary importance.

PBN is a core component of international initiatives to meet industry and air traffic goals. The FAA works closely on harmonization efforts with its partners, International Civil Aviation Organization and the Single European Sky ATM Research program, to ensure consistency in requirements for the delivery of global air traffic services.

### NavLean Process

In 2010, the FAA and RTCA, a federal advisory committee on aviation-related technical matters, initiated a joint initiative between Aviation Safety and Air Traffic Management to identify ways to improve and streamline the processes used for developing and implementing Instrument Flight Procedures.

A copy of the [Navigation Procedures Project](#) (NavLean) is available in the library on the NextGen website.